UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
8604 La Jolla Shores Drive
La Jolla, California 92038

15 April, 2004

FINAL CRUISE REPORT

VESSEL: NOAA Ship *McArthur II*

CRUISE NUMBERS: OMAO cruise number AR-03-04 and SWFSC Marine Mammal Cruise Number 1623

CRUISE DATES: 29 July to 10 December 2003

PROJECT: *Stenella* Abundance Research Project (STAR)

SPONSOR: NOAA, NMFS, Southwest Fisheries Science Center (SWFSC), Protected Resources Division (PRD)

CHIEF SCIENTIST: Dr. Lisa T. Ballance, SWFSC (858) 546-7173, Lisa.Ballance@noaa.gov

ITINERARY:

LEG 1: 29 JUL- Depart San Diego, CA	27 AUG- Arrive Honolulu, HI
LEG 2: 04 SEP - Depart Honolulu	30 SEP- Arrive Puntarenas, Costa Rica
LEG 3: 6 OCT - Depart Puntarenas	27 OCT- Arrive Callao, Peru
LEG 4: 31 OCT- Depart Callao	15 NOV- Arrive Panama City, Panama
LEG 5: 19 NOV- Depart Panama City	10 DEC- Arrive San Diego, CA

CRUISE DESCRIPTION AND OBJECTIVES: The primary objective of the *Stenella* Abundance Research cruise is to investigate trends in population size of those dolphin stocks most affected by the eastern tropical Pacific tuna purse-seine fishery. The STAR project takes a multidisciplinary approach. Data on cetacean distribution, school size and school composition are collected to determine dolphin abundance. Oceanographic data are collected to characterize habitat and its variation over time. Data on distribution and abundance of seabirds, flyingfish, and marine turtles will further characterize the ecosystem in which these dolphins live. Skin biopsies of cetaceans provide a database for investigations of stock structure and phylogenetic relationships. Photographs document geographic variation in dolphins, and distribution of individual large whales.

The STAR 2003 cruise was a two ship project. Activities of the other vessel, NOAA Ship *David Starr Jordan*, are covered in a separate report.

STUDY AREA:
The eastern tropical Pacific Ocean (ETP). Tracklines covered are shown in **Figure 1**.

1.0 PROCEDURES FOR DAYLIGHT OPERATIONS

1.1 Cetacean Survey - Line-transect survey methods were used to collect abundance data. At the beginning of each day search effort started on the trackline. The *McArthur II* travelled at 10 knots (through the water) along the designated trackline. While on search effort, if the ship's speed through the water deviated from this by more than one knot, the bridge personnel notified the mammal team on watch or the Cruise Leader. A daily watch for cetaceans was maintained on the flying bridge during daylight hours (approximately 0600 to 1800) by 6 mammal observers. Each observer worked in 2-hour rotations, manning each of the following 3 stations on the flying bridge for 40 minutes: a port side 25x150 binocular station, a center line data recorder position, and a starboard 25x150 binocular station.

1.1.1 Logging of Data - A log of observation conditions, watch effort, sightings, and other required information were entered into a computer, hooked up to the ship's Global Positioning System (GPS - for course, speed and position information) and Scientific Computing System (SCS - for weather and heading information). An “independent observer” occasionally kept a separate watch of animals sighted during the cetacean survey operations, to be compared later with the observer team’s data.

1.1.2 Breaking Trackline - On sighting a cetacean school or other feature of biological interest, the Cruise Leader or marine mammal observer team on watch requested that the vessel be maneuvered to approach the school or feature for investigation. When the ship approached a school of dolphins, the observers made independent estimates of school size. Biopsy and photographic operations commenced from the bow, based on directions from the Cruise Leader or Senior Marine Mammal Observers. In some instances, the Cruise Leader requested the deployment of a small boat for biopsy, photographic or other operations (see 1.3). It was occasionally necessary to divert the ship's course from the established trackline during regular effort due to glare or adverse sea conditions. Under these circumstances, the ship was diverted up to 30 degrees from the established course. This deviation was continued until the ship was 10 nm from the trackline, at which point the ship turned back toward the trackline.

1.1.3 Resuming Effort - When the observers had completed scientific operations for the sighting, the ship resumed the same course and speed as prior to the sighting. If the pursuit of the sighting took the ship more than 10 nm from the trackline, the observers were notified. The Cruise Leader or Senior Marine Mammal Observers often requested that, rather than proceed directly toward the next waypoint, the ship take a heading of 20 degrees back toward the trackline.

1.2 Seabird Survey - Visual surveys of seabirds were conducted from the flying bridge during daylight hours by two seabird observers on a rotational watch schedule. Sighting conditions, effort, sightings, and other required information were entered into a computer interfaced with the ship’s GPS (for course, speed, and position information) and SCS (for weather and heading information). Seabird observers used both handheld and 25x150 binoculars.

1.3 Small Boat Work - A small boat was often necessary for biopsy sampling, photography, seabird collection, and marine turtle work. Deployment was requested by the Cruise Leader on an opportunistic basis, occasionally multiple times in a single day, providing the Commanding Officer concurred that operating conditions were safe. Unless the Commanding Officer allowed otherwise, the small boat remained within sight and radio contact at all times while deployed.

1.4 Biopsy Sampling – Biopsy samples for genetic analyses of marine mammals were collected on an opportunistic basis. Necessary permits were present on the vessel. The animals to be sampled were either approached by the research vessel during normal survey operations, approached the vessel on their own, or were approached by a small boat. Samples were collected from animals within 10 m to 30 m of the bow of the vessel, using a dart fired from a crossbow or rifle. With the exception of the small boat and safety apparel, all necessary gear was furnished and deployed by the scientific party.

1.5 Photography - Photographs of cetaceans were taken on an opportunistic basis. These were used to study social behavior and movement patterns of identified individuals, and to study geographic variation. Necessary permits were present on the vessel. The animals to be photographed were either approached by the research vessel during normal survey operations, or approached the vessel on their own, or were approached by a small boat. With the exception of the small boat and safety apparel, all necessary gear was furnished by the scientific party.

1.6 Marine Turtle Research - A visual survey for marine turtles was carried out by the mammal and seabird observers on the flying bridge during all daylight hours. Data were recorded in both mammal and seabird databases. Marine turtles were captured on an opportunistic basis, at the discretion of the Cruise Leader. Turtles were measured, weighed, and tagged. All turtles were subsequently released. With the exception of the small boat and safety apparel, all necessary gear was supplied and operated by the scientific party. All necessary permits were aboard the vessel.

1.7 Collection of Fish - Fish were collected on an opportunistic basis at the discretion of the Cruise Leader. While underway, trolling gear was used when conditions permitted. While stationary, hook-and-line gear was used. Fish were measured, sexed, and stomach contents were examined and recorded by scientific personnel. The Cruise Leader was responsible for the disposition of the catch, in accordance with NOAA Administrative Order 202-735B, dated January 9, 1989. All flyingfish specimens that landed on the decks were collected by the scientific party and frozen.

1.7.1 Collection for Food-web Isotope Project – Samples from the same fish collected under 1.7 were taken for the Food-web Isotope Project. The date, location, time of day, species, length, and sex of each fish was recorded by scientific personnel. The stomach was removed and frozen, with stomach contents intact, after being examined under 1.7. A piece of the liver and a core of white muscle was also removed and frozen. R. Olson, Inter-American Tropical Tuna Commission (IATTC), provided supplies and instructions.

1.8 Salvage of Marine Mammals – A whale carcass was salvaged for necropsy and subsequent study. Permits to salvage marine mammal parts were present on the vessel.

1.9 Tropical Atmosphere Ocean (TAO)Buoys - The ship retrieved scientific instruments from a single buoy at the request of the TAO project.

1.10 Acoustics -

1.10.1 Sonobuoys - Sonobuoys were deployed periodically from either the *McArthur II* or a small boat on an opportunistic basis, at the discretion of the Cruise Leader. With the exception of the small boat, all of the necessary equipment was supplied and operated by scientific personnel.

1.10.2 Towed Array - A small hydrophone array was towed during daylight hours during

Legs 3, 4, and 5 of the cruise to collect data on cetacean vocalizations, and to assess the acoustic characteristics of the vessel for future Protected Resources Division projects. The array was deployed in the morning prior to the start of visual observations, and was retrieved in the evening after search effort ended (and whenever increased maneuverability was required). The array was wound onto a hydraulic-powered winch supplied by the SWFSC. A team of two acoustic technicians monitored the array, recorded sounds made by cetaceans, and localized their positions. Recordings were made of all cetacean detections during legs 3, 4, and 5.

1.11 Oceanography - Oceanographic sampling was done by the oceanographer, the Chief Survey Technician, and other designated scientists, while underway.

1.11.1 Expendable Bathythermograph (XBT) Drops – There were three XBT drops per day, at 0900, 1200 and 1500 hours local ship time, or as requested by the Cruise Leader. The XBT's were provided by SWFSC. If the vessel stopped at the scheduled launch time, the drop was delayed until the ship was again underway. When the vessel was not going to move within half an hour, the scientist performing the drop was notified and the drop was delayed or canceled, at the discretion of the Cruise Leader.

1.11.2 Surface Water Samples – A surface water sample for chlorophyll *a* analysis and a bucket temperature was taken at 0900, 1200, 1500, and 1800 hours local ship time daily.

1.11.3 Thermosalinograph Sampling – A thermosalinograph (TSG), was used for continuous measurement of surface water temperature and salinity. A data acquisition system (WinDACS) furnished by SWFSC was connected to the TSG output from the Sea-Bird Electronics interface box. This computer received the raw data, with the NMEA position string attached to each record. Additionally, this computer was connected to the ship's LAN, in order to synchronize with the ship's time server. The Scientific Computing System (SCS) also collected this information. The oceanographer provided the ship's Operations Officer and Electronics Technician with detailed SCS acquisition information before departure. All SCS data were provided to the SWFSC oceanographer following each leg of the cruise.

1.11.4 Drifter Buoy deployments – A small number of drifter buoys were deployed by scientific personnel for the NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML) Global Drifter Center at predetermined locations.

2.0 PROCEDURES FOR NIGHT OPERATIONS

2.1 Marine Operations Log - A chronological record of oceanographic and net tow stations was kept by the ship, with dates and times in GMT. The ship provided a printed copy of the electronic marine operations log (with the cruise Weather Log and SCS data) to the SWFSC oceanographer at the completion of the cruise.

2.2 CTD Operations - The main SeaBird CTD system was provided by NOAA Marine Operations Center – Pacific (MOC-P) and operated by the Chief Survey Technician and the scientific party. The collection of oceanographic data, samples and their processing were conducted by the Chief Survey technician and the scientific party. The crew of the vessel operated all deck equipment and was responsible for the termination (and any necessary reterminations) of the CTD cable pigtail to the conducting cable of the winch.

2.2.1 CTD Stations - Two CTD stations were occupied each night. CTD data and seawater samples were collected using a SeaBird 9/11+ CTD with rosette (General Oceanics) and Niskin bottles fitted with silicone tubing and o-rings (supplied by the oceanographer). All casts were to 1000 meters, with the descent rate at 30m/min for the first 100m of the cast, then 60m/min after that, including the upcast between bottles. From each cast, chlorophyll samples (to 200 m) and salinity samples (500 and 1000 m or bottom) were collected and processed on board. The 265ml chlorophyll samples were filtered onto GF/F filters, placed in 10ml of 90% acetone, refrigerated for 24 hours, and then analyzed on a Turner Designs model 10AU field fluorometer. Nutrient samples (0 - 500 m) were collected, frozen, and stored on board. Cast times were subject to change since sunrise and sunset varied during the cruise. Additional CTD stations were requested by the Cruise Leader in areas of special interest.

2.2.1.1 Pre-Daylight cast - The morning cast (1000 m) began approximately one and one-half hours prior to sunrise. This exact starting time was determined the evening before, by the Field Operations Officer (FOO). Niskin bottle water samples were collected at seven light depths and five additional standard depths, between the surface and 1000 meters. These depths were determined just prior to each cast by entering the ship's position into a computer program. Primary productivity was measured by radioactively labeled carbon uptake methods. The seven samples in bottles were spiked with ^{14}C, incubated on deck for 24 hours, filtered, and stored for later analysis at the SWFSC. The Niskin bottles (#1-7) were rinsed after each cast and acid-washed at the end of each leg. In San Diego, the oceanographers were trained by SWFSC personnel in the use of radioactivity prior to departure.

2.2.1.2 Post Effort Cast - An evening CTD cast, to 1000 meters, was conducted a minimum of one hour after sunset. The exact time was determined by the FOO. Bottle samples were collected from 12 standard depths (0, 20, 40, 60, 80, 100, 120, 140, 170, 200, 500, 1000 m). Samples for chlorophyll, nutrients and salts were taken as listed above (except the addition of four salinity samples taken from every other evening cast).

2.3 Filtering water samples - Concurrent with the evening CTD station, small samples of particulate organic matter (POM) and zooplankton were collected by the oceanographer from the ship's uncontaminated seawater system for the Food-web Isotope Project. Seawater was collected, placed in a pressurized carboy filtration system, and left for approximately an hour. For POM collection, the water was pre-filtered to remove large particles, then filtered from the carboy on to 25-mm glass fiber filters. The glass fiber filters were stored frozen. For zooplankton collection, seawater collected from the sea surface was poured over a home-made nitex filter and stored frozen. R. Olson, IATTC, provided the sampling equipment and instructions for this and other sampling for the Food-web Isotope Project.

2.4 Net Sampling: Net tows were conducted by the Chief Survey Technician and the scientific party with the assistance of a winch operator from the vessel.

2.4.1 Dipnetting – Concurrent with the evening CTD station, dipnetting for surface fauna was conducted by scientific personnel, for one full hour, from the port side of the ship. This station began no sooner than one full hour after sunset. One or more deck lights were necessary to illuminate the water surface in the area of dipnet sampling. Samples were preserved, labeled, and stored in the vessel's freezer. Scientists also collected surface fauna for aquaria on board. All live organisms were donated to the Birch Aquarium upon return to San Diego.

2.4.1.1 Dipnetting for Food-web Isotope Project – Surface fauna collected under 2.4.1 were shared with the Food-web Isotope Project, at the discretion of the Cruise Leader and the scientist directing this activity. Samples were labeled and stored in the vessel's freezer.

2.4.2 Manta Tow - A surface manta net tow was conducted for fifteen minutes immediately following the post-sunset CTD station and dipnetting. Average completion time for the entire procedure was 30 minutes. The net was deployed from the starboard hydro winch. Samples were preserved in formalin, labeled, and stored in containers provided by the SWFSC until the vessel returned to San Diego.

2.4.3 Bongo Tow - An oblique Bongo tow was conducted after the Manta tow (45 minute station time), to a depth of 200 meters (wire out 300m on starboard hydro winch). Samples were preserved in formalin, labeled, and stored in containers provided by the SWFSC until the vessel returned to San Diego.

2.5 Transit - When scientific operations were complete for the night, the ship resumed course along the trackline, at a speed determined by the Cruise Leader, until it was necessary to stop for the morning (pre-daylight) CTD station.

3.0 SCIENTIFIC PERSONNEL

3.1 Chief Scientist - The Chief Scientist was Dr. Lisa T. Ballance, SWFSC.

3.2 Participating Scientists -

Leg 1: **Leg 2:**

Name	**Position**	**Name**	**Position**
Lisa Ballance	Cruise Leader	Sarah Mesnick	Cruise Leader
James Cotton	Senior Mammal Observer	James Cotton	Senior Mammal Observer
Gary Freidrichsen	Senior Mammal Observer	Gary Freidrichsen	Senior Mammal Observer
Ernesto Vazquez	Mammal Observer	Ernesto Vazquez	Mammal Observer
Chris Cutler	Mammal Observer	Chris Cutler	Mammal Observer
Cornelia Oedekoven	Mammal Observer	Cornelia Oedekoven	Mammal Observer
Beth Goodwin	Mammal Observer	Beth Goodwin	Mammal Observer
Michael Force	Seabird Observer	Michael Force	Seabird Observer
Richard Pagen	Seabird Observer	Richard Pagen	Seabird Observer
Candice Hall	Oceanographer	Melinda Kelley	Oceanographer
Jessica Redfern	Visiting Scientist	Larry Standley	Visiting Scientist
Eric Ward	Visiting Scientist	Mari Rosales	Visiting Scientist
Mary Tapia	Ecuadorean Observer		

Leg 3: **Leg 4:**

Name	**Position**	**Name**	**Position**
Susan Chivers	Cruise Leader	Barb Taylor	Cruise Leader
Richard Rowlett	Senior Mammal Observer	Richard Rowlett	Senior Mammal Observer
Juan Carlos Salinas	Senior Mammal Observer	Juan Carlos Salinas	Senior Mammal Observer
Erin LaBrecque	Mammal Observer	Erin LaBrecque	Mammal Observer
Anne Douglas	Mammal Observer	Anne Douglas	Mammal Observer
Holly Fearnbach	Mammal Observer	Holly Fearnbach	Mammal Observer
Michael Richlen	Mammal Observer	Michael Richlen	Mammal Observer
Michael Force	Seabird Observer	Michael Force	Seabird Observer
Chris Hoefer	Seabird Observer	Dawn Breese	Seabird Observer
Melinda Kelley	Oceanographer	Melinda Kelley	Oceanographer
Shannon Rankin	Acoustician	Shannon Rankin	Acoustician
Megan Ferguson	Acoustician	Jenna Borberg	Acoustician
Hadoram Shirihai	Visiting Scientist	Jason Larese	Visiting Scientist
Paul Fiedler	Visiting Scientist	Josh Fluty	Visiting Scientist
Richard Condit	Visiting Scientist	Phil Morin	Visiting Scientist

Leg 5:

Name	Position
Tim Gerrodette	Cruise Leader
Richard Rowlett	Senior Mammal Observer
Juan Carlos Salinas	Senior Mammal Observer
Erin LaBrecque	Mammal Observer
Anne Douglas	Mammal Observer
Holly Fearnbach	Mammal Observer
Michael Richlen	Mammal Observer
Michael Force	Seabird Observer
Dawn Breese	Seabird Observer
Melinda Kelley	Oceanographer
Julie Oswald	Acoustician
Carolina Bonin	Acoustician
Ruben Lopez Bran	Guatemalan Observer
Jose Marquez	Peruvian Observer
Cleridy Lennert	Visiting Scientist

4.0 RESULTS

The following summarize the area surveyed (Figure 1) and data collected:

Table 1: Cetacean sightings

Table 2: Seabird sightings

Table 3: Marine turtle sightings

Table 4: Marine turtles tagged

Table 5: Dipnet samples

Table 6: Cetacean biopsy samples

Table 7: 35mm and digital photography

Table 8: Acoustic recordings

Table 9: Cetacean behavior

Table 10: Environmental data

5.0 DISPOSITION OF DATA

All data are currently being analyzed. The final data reports will be completed by February 2005.

Marine mammal data were delivered to the Dr. Tim Gerrodette, SWFSC for analysis and distribution.

Passive acoustic data were delivered to Dr. Jay Barlow, SWFSC for analysis and distribution.

Acoustic backscatter data were delivered to Dr. David Demer, SWFSC for analysis and distribution.

Oceanographic data were delivered to Dr. Paul Fiedler, SWFSC for analysis and distribution.

Biopsy samples were delivered to Dr. Barbara Taylor, SWFSC for analysis and distribution.

Ecosystem data (seabirds, turtles, net samples) were delivered to the Chief Scientist, Dr. Lisa T. Ballance, SWFSC for analysis and distribution.

Prepared by: _____ Date: 4-15-2004
LTJG Jason Appler
Survey Coordinator, STAR 2003

Prepared by: L. T. Ballance Date: 4/15/2004
Dr. Lisa T. Ballance
Chief Scientist, STAR 2003

Approved by: _____ Date 4/15/04
Dr. Stephen B. Reilly
Chief, Protected Resources Division

Approved by: Richard G. Hazel for Date 4/13/04
Dr. William W. Fox, Jr.
Director, Southwest Fisheries Science Center

Figure1: Trackline surveyed during daylight hours aboard *McArthur II* during STAR 2003.

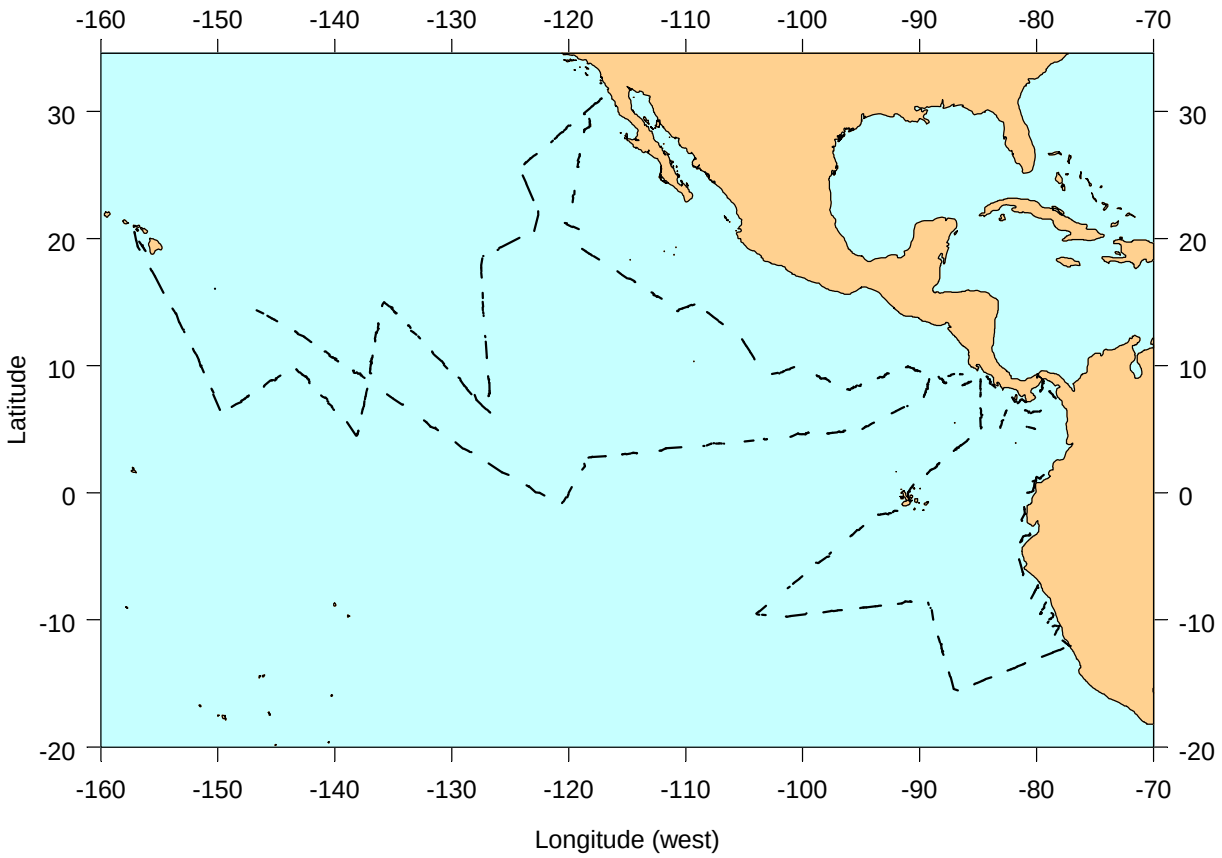

Table 1:
Summary of cetacean sightings during STAR 2003 aboard *McArthur II*.

Sighting Category	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Total
Stenella coeruleoalba	31	19	20	9	46	125
Unid. dolphin	33	36	5	2	14	90
Stenella attenuata (offshore)	33	22	5	1	23	84
Tursiops truncatus	3	8	10	19	24	64
Delphinus delphis	7	6	10	8	21	52
unid. small delphinid			2	6	36	44
Globicephala macrorhynchus	11	14	11	1	5	42
Stenella longirostris (whitebelly)	26	6		1	4	37
Stenella attenuata graffmani				12	23	35
Grampus griseus	5	2	9	6	8	30
Balaenoptera sp.	7	7	5	1	4	24
Physeter macrocephalus	7	3	8	1	1	20
Balaenoptera edeni	2	7	4	4	3	20
Megaptera novaeangliae				19		19
Stenella longirostris orientalis	1	2	1	1	13	18
Balaenoptera musculus			6		12	18
unid. large whale	3	3	5		2	13
Lagenorhynchus obscurus			1	11		12
Balaenoptera borealis/edeni	4	1	4	1	2	12
Steno bredanensis	3	6			2	11
Delphinus capensis				10		10
Mesoplodon sp.	7		2	1		10
unid. small whale	7	3				10
unid. medium delphinid			4	4	2	10
Kogia sima	5	1			3	9
Stenella longirostris (unid. subsp.)	3	3		2		8
Ziphius cavirostris		2	1		5	8
Stenella longirostris (southwestern)	2	5	1			8
Pseudorca crassidens		6			1	7
Orcinus orca	3	2		1	1	7
Mesoplodon peruvianus			1		4	5
Ziphiid whale	1		2	1	1	5
Balaenoptera borealis				5		5
unid. whale	1	1	2	1		5
unid. cetacean		2		1	1	4
Feresa attenuata	1	1				2
Globicephala sp.			2			2
Balaenoptera physalus			1		1	2
unid. large delphinid	2					2
Delphinus sp.				1		1
Lagenodelphis hosei			1			1
Phocoena spinipinnis				1		1
Berardius bairdii	1					1
Mesoplodon sp. A		1				1
Stenella attenuata (unid. subsp.)					1	1
unid. pinniped					1	1
Total	**209**	**169**	**123**	**131**	**264**	**896**

Table 2:
Seabirds sighted during STAR 2003 aboard *McArthur II*.

Common name	Scientific name	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Total
Albatrosses	Diomedeidae	1	0	7	44	2	**54**
Shearwaters	*Puffinus* spp.	480	369	81	1523	201	**2654**
Petrels	*Pterodroma* spp., *Fulmarus* spp.	810	509	347	140	38	**1844**
Skuas	Catharactidae	0	3	3	14	2	**22**
Cormorants	Phalacrocoracidae	0	0	0	2766	0	**2766**
Storm-petrels	Oceanitidae	262	133	3394	196	315	**4300**
Tropicbirds	Phaethontidae	25	23	30	9	23	**110**
Boobies	Sulidae	43	141	100	3270	457	**4011**
Frigatebirds	Fregatidae	6	32	63	262	26	**389**
Phalaropes	Phalaropodidae	8	7	1099	591	41	**1746**
Jaegers	Stercorariidae	8	30	43	67	33	**181**
Gulls	*Larus* spp.	2	0	10	1435	26	**1473**
Terns	*Sterna* spp., *Gygis* sp., *Chlidonias* spp., *Anous spp.*	226	416	188	298	234	**1362**
Penguins	Spheniscidae	0	0	0	2	0	**2**
Auks	Alcidae	4	0	0	0	2	**6**
	Total	**1875**	**1663**	**5365**	**10617**	**1400**	**20920**

Table 3:
Summary of marine turtle sightings during STAR 2003 aboard *McArthur II*.

Species/Taxon	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Total
Caretta Caretta	1				2	**3**
Chelonia mydas			2			**2**
Lepidochelys olivacea	1	11	4	29	332	**377**
Unidentified hardshell	7	4		6	19	**36**
Unidentified turtle	10	2				**12**
Total	**19**	**17**	**6**	**35**	**353**	**430**

Table 4:
Marine turtles tagged during STAR 2003 aboard *McArthur II*.

Species	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Leg 6	Total
Lepidochelys olivacea	5						**5**

Table 5:
Dipnet samples collected during STAR 2003 aboard *McArthur II*.

	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Total
no. stations	29	17	16	10	17	**89**
no. fish	295	144	104	120	473	**1136**

Table 6:
Cetacean biopsy samples collected during STAR 2003 aboard *McArthur II*.

SPECIES	Skin	Blubber
Balaenoptera physalus	1	0
Balaenoptera musculus	6	4
Delphinus capensis	5	5
Delphinus delphis	2	2
Globicephala macrorhynchus	42	35
Lagenorhynchus obscurus	4	1
Megaptera novaeangliae	2	2
Mesoplodon peruvianus	1	1
Orcinus orca	3	1
Physeter macrocephalus	4	1
Stenella attenuata	2	0
Stenella attenuata graffmani	46	33
Tursiops truncatus	36	26
Total	**154**	**111**

Table 7:
Total photographs of cetacean schools/individuals (35mm and digital) obtained during STAR 2003 aboard *McArthur II*.

Species/Stock	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5
Balaenoptera borealis	0	0	0	7	0
Balaenoptera borealis edeni	0	0	0	0	1
Balaenoptera edeni	0	4	6	6	3
Balaenoptera musculus	0	0	11	0	13
Balaenoptera physalus	0	0	2	0	2
Delphinus capensis	0	0	0	13	1
Delphinus delphis	3	10	7	9	17
Globicephala macrorhynchus	4	9	18	1	1
Grampus griseus	1	0	1	5	2
Lagenodelphis hosei	0	0	2	0	0
Lagenorhynchus obscurus	0	0	12	3	0
Megaptera novaeangliae	0	0	0	17	0
Mesoplodon sp.	0	0	0	0	1
Orcinus orca	0	2	0	1	0
Physeter macrocephalus	5	0	4	0	3
Pseudorca crassidens	0	1	0	0	2
Stenalla attenuata graffmani (coastal)	0	0	2	14	13
Stenella attenuata (*attenuata*)	4	4	1	3	14
Stenella attenuata (unid)	1	0	0	0	1
Stenella coeruleoalba	4	3	16	9	30
Stenella longirostris (eastern/*orientalis*)	0	0	1	4	8
Stenella longirostris (unid)	8	4	2	1	0
Stenella longirostris (whitebelly)	0	0	0	0	3
Steno bredanensis	1	0	0	0	2
Tursiops truncatus	2	3	1	15	23

Table 8a:
Number of cetacean schools recorded using a towed hydrophone array on the *McArthur II* during STAR 2003.

Species	Leg 3	Leg 4	Leg 5	Total
Unidentified Dolphins (sighted)	5	2	11	18
Unidentified Dolphins (non-sighted)	21	14	13	48
S. coeruleoalba	14	8	26	48
S. attenuata	3	11	21	35
D. delphis	6	6	13	25
T. truncatus	2	12	8	22
G. griseus	2	4	3	9
Globicephala sp.	5	1	2	8
D. capensis	0	3	1	4
S. longirostris	0	1	3	4
L. obscurus	0	3	0	3
P. crassidens	0	0	1	1
S. attenuata, S. longirostris	2	1	10	13
Globicephala, T. truncatus	2	0	3	5
L. obscurus, Delphinus sp.	0	5	0	5
Globicephala, G. griseus, T. truncatus	2	0	0	2
S. attenuata, Delphinus sp.	0	1	1	2
Globicephala, G. griseus	1	0	0	1
L. obscurus, T. truncatus	0	1	0	1
G. griseus, T. truncatus	0	1	0	1
S. bredanensis, T. truncatus	0	0	1	1
S. coeruleoalba, Delphinus sp.	0	0	1	1
P. macrocephalus (sighted)	5	1	1	7
P. macrocephalus (non-sighted)	14	2	0	16
B. acutorostrata (non-sighted)	0	0	17	17
Total	**84**	**77**	**136**	**297**

Table 8b:
Number of cetacean schools recorded with sonobuoys on the *McArthur II* during STAR 2003.

Species	Recordings
B. musculus	15
B. edeni	8
B. edeni/borealis	3
B. physalus	3
O. orca	2
B. borealis	2
L. hosei	1
P. macrocephalus	1
Globicephala sp.	1
M. novaeangliae	1
Total	**37**

Table 9:
Number of cetacean schools with behavioral data collected during STAR 2003 aboard *McArthur II*.

Species	Leg 1	Leg 2	Leg 3	Leg 4	Leg 5	Total
Stenella coeruleoalba	15	20	9	9	29	82
Tursiops truncatus	16	7	13	7	8	51
Stenella attenuata (offshore)	23	10	4	1	11	49
Delphinus delphis	1	6	12	12	8	39
Stenella longirostris (whitebelly)	18	1	1			20
Stenella attenuata graffmani			2	7	2	11
Stenella longirostris orientalis	1				9	10
Globicephala macrorhynchus	3	2	3		2	10
Steno bredanensis	3	1	1	1	1	7
Delphinus capensis				6	1	7
Grampus griseus	2		1	2	2	7
Globicephala sp.			5	2		7
Stenella longirostris (southwestern)	1	5	1			7
Unidentified dolphin or porpoise	2		2		2	6
Stenella longirostris (unid. subsp.)	1		1		1	3
Stenella attenuata (unid. subsp.)				3		3
Orcinus orca	1		1			2
Delphinus sp.				1		1
Lagenorhynchus obscurus				1		1
Pseudorca crassidens	1					1
Indopacetus pacificus	1					1
Total	**89**	**52**	**56**	**52**	**76**	**325**

Table 10:
Summary of environmental data collected during STAR 2003 aboard *McArthur II*.

	Leg 1	**Leg 2**	**Leg 3**	**Leg 4**	**Leg 5**	**Totals**
CTD casts	52	30	34	23	36	**175**
CTD chlorophyll samples	497	286	331	198	336	**1648**
Surface chlorophyll samples	102	80	122	49	108	**461**
Primary productivity samples	144	142	124	76	125	**611**
Nutrient samples	540	314	360	213	367	**1794**
Salinity samples	157	87	101	67	105	**517**
XBT drops	94	94	114	44	102	**448**
Manta Tows	27	9	15	10	15	**76**
Bongo Tows	27	9	15	6	15	**72**